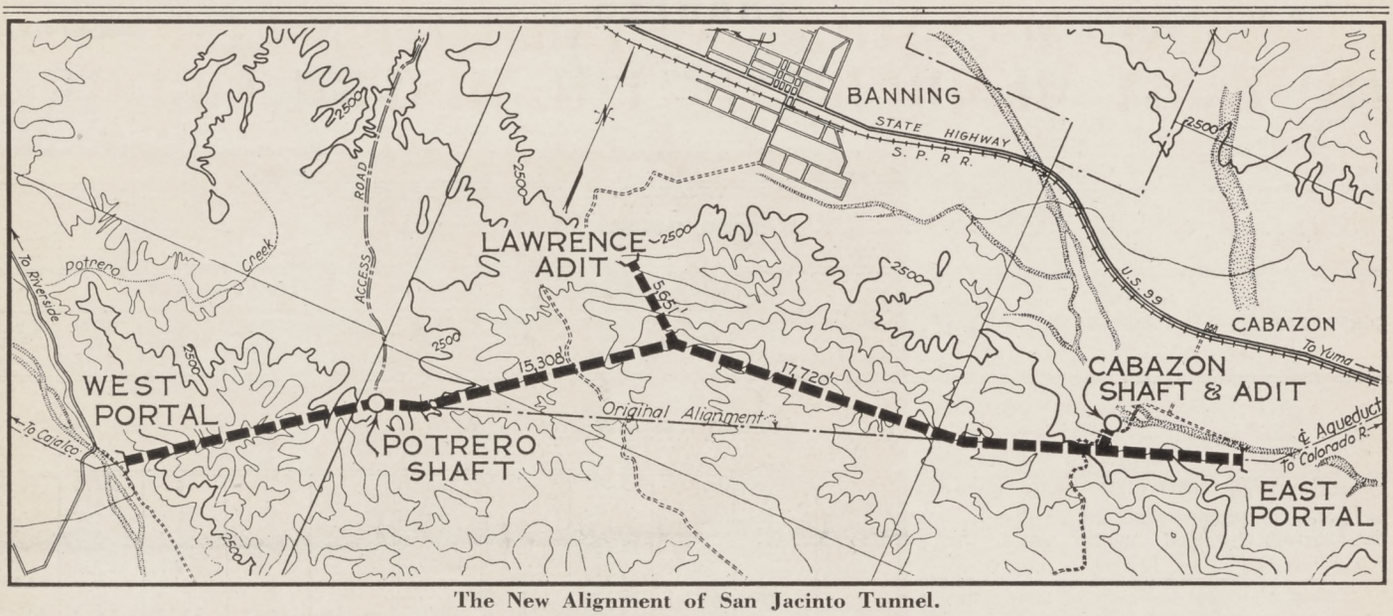


The New Alignment of San Jacinto Tunnel.

SAN JACINTO PIONEER TUNNELING BEGUN

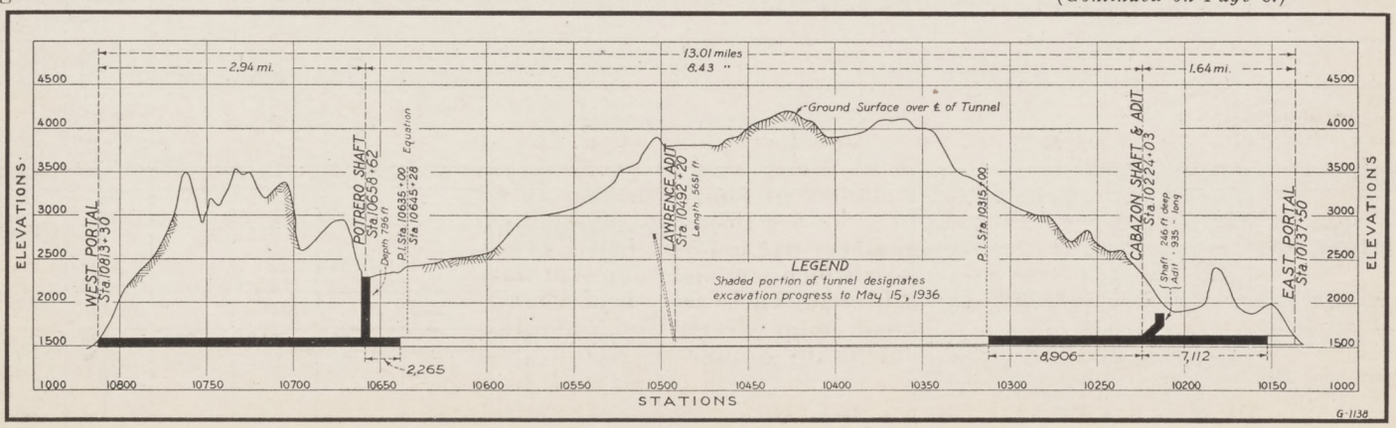
By W. L. CHADWICK,

With the shooting last week of the first round in the pioneer tunnel, to be driven between the Cabazon and Potrero headings, there occurred an event in San Jacinto tunnel history equal in importance to the dates when shaft sinking was first started at Cabazon and Potrero. Another event of equal importance was the shooting of the first round at Lawrence adit on March 23, 1936.

The pioneer tunnel is to be a small, parallel bore, nine or ten feet wide by ten feet high, and seventy-five feet to the south of the main tunnel. Because of its smaller size, this auxiliary tunnel can be driven at a faster rate than the full-sized tunnel, particularly through bad ground. This faster progress will make it possible to excavate the pioneer heading ahead of the main tunnel, thus thoroughly exploring the ground ahead. Whenever difficult excavation is encountered in the pioneer similar difficulties may be expected in the main heading when the latter reaches the same general area. With the locations of such difficulties known, cross-cuts or drifts will be driven laterally from the pioneer to the main tunnel, and excavation, timbering, grouting, and other operations will be carried on in the main tunnel using the pioneer and the cross-cuts for access. The chief advantage of the pioneer system is that it enables work to be carried forward simultaneously at a number of different points on the main tunnel. Thus, because it has been prepared in advance, a section of bad ground, when encountered in the main tunnel, does not hold up progress on the tunnel as a whole; also, regardless of conditions in the main heading work is continuing at other points through the cross-cuts. Cross-cut spacing will be determined by the kind of ground encountered. It is anticipated that after a few months the pioneer may be advanced sufficiently to allow advance work in enough places so that main-heading excavation may be kept up to the rate of driving in the pioneer. The pioneer will be driven both from Cabazon and Potrero and if necessary will also be driven each way from Lawrence adit when the latter is completed.

At Cabazon the pioneer will be driven so that it will drain away from the face, regardless of the main tunnel grade. To accomplish this a short section of pioneer, about 100 feet long, will be driven sharply downhill at about 3 per cent grade, making a drop of about 3 feet. At the bottom of this section a pump sump will be located, but driving will proceed from there on an uphill grade of 0.13 per cent until the 3 feet dropped at the start, and the normal tunnel grade, have been overcome. This process will be repeated over and over, as required. In effect the pioneer grade will be "sawtoothed," but the grade at the top of the "sawtooth" will be parallel to that in the main tunnel. Pumps and pipe lines will take the water away from the sumps to the surface; by this plan most of the disadvantage of downhill headings will be overcome. In addition

(*Continued on Page 8.*)



San Jacinto Tunnel in Profile.

TUNNELS

April 15 to May 15, 1936

TUNNEL EXCAVATION (MILES)

	Completed	Remaining
Aqueduct	85.16	6.88
Distribution	11.53	4.70
Total	96.69	11.58

* TUNNEL LINING (MILES)

	Completed	Remaining
Aqueduct	40.68	51.36
Distribution	0.52	15.71
Total	41.20	67.07

* Arch considered to equal 0.9 of completed section.

TUNNEL PROGRESS

CONTRACTOR	TUNNEL	LENGTH IN FEET	EXCAVATION IN FEET					LINING IN FEET					
			NUMBER OF SHIFTS	AVERAGE PER SHIFT	THIS PERIOD	TOTAL TO DATE	REMAINING	ARCH OR INVERT	NUMBER OF SHIFTS	AVERAGE PER SHIFT	THIS PERIOD	TOTAL TO DATE	REMAINING
AQUEDUCT—CONTRACT													
WALSH CONSTRUCTION CO.	COLORADO RIVER	5,482			Completed	5,482	0	Arch			0	5,475	7
								Invert				5,475	7
	COPPER BASIN NO. 1	705			Completed	705	0	Arch			0	696	9
								Invert			0	696	9
	COPPER BASIN NO. 2	11,568			Completed	11,568	0	Arch			0	11,568	0
								Invert			0	11,568	0
	WHIPPLE MOUNTAIN	(32,238)				(32,238)	(0)					0	(32,238)
	East from Adit	18,336			Completed	18,336	0						
	West from Adit	13,902			Completed	13,902	0	Arch	19	84.8	1,612	1,612	30,626
WINSTON BROTHERS	IRON MT. (E. PORTION)	(23,645)				(23,645)	(0)						
	East from Shaft	9,902			Completed	9,902	0	Arch	7	33.0	231	231	9,671
	West from Shaft	13,743			Completed	13,743	0	Arch	49	58.6	2,872	13,728	15
UTAH CONSTRUCTION CO.	IRON MT. (W. PORTION)	16,172			Completed	16,172	0	Arch	71	60.5	4,289	6,368	9,804
WINSTON BROTHERS	COXCOMB (From E. Portal)	17,795			Completed	17,795	0					0	17,795
BRODERICK & GORDON	E. EAGLE (From W. Portal)	9,440				9,440	0					0	9,440
	W. EAGLE (E. PORTION)	(15,845)				(15,845)	(0)					0	(15,845)
	East from Adit	7,871				7,871	0						
	West from Adit	7,974				7,974	0						
DRAVO CONTRACTING CO.	VALVERDE	(38,015)				(38,015)	0						
	East Portal to Shaft 3	21,415			Completed	21,415	0	Arch	83	43.9	3,645	33,224	4,791
	West from Shaft 3				Completed	8,964		Invert	26	189.6	4,929	26,425	11,590
	East from Adit	12,067			Completed	3,103	0						
	West from Adit	4,533			Completed	4,533	0						
	TOTALS Ft.	170,905				170,905	0	Arch	229	56.0	11,037	72,902	98,003
	Miles	(32.37)			0	(32.37)	(0)	Invert	26	189.6	4,929	44,164	126,741
AQUEDUCT — FORCE ACCOUNT													
THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA	EAST COACHELLA	(96,605)				(96,605)	0						
	East Portion	42,910			Completed	42,910	0	Arch	78	64.2	5,011	26,470	16,440
								Invert			0	10,022	32,888
	West Portion	53,695			Completed	53,695	0	Arch	78	54.9	4,285	21,042	32,653
								Invert				0	53,695
	1000 PALMS NO. 1 (From W.P.)	16,058				16,058	0					0	16,058
	1000 PALMS NO. 2	3,838			Completed	3,838	0	Arch			0	3,838	0
								Invert				3,838	0
	WIDE CANYON NO. 1	14,305			Completed	14,305	0	Arch			0	14,305	0
	WIDE CANYON NO. 2	848			Completed	848	0	Arch				848	0
	SEVEN PALMS (From E. Prtl)	4,810				4,810							
	(From W. Prtl)	11,920			Completed	11,920	0	Arch				16,730	0
	LONG CANYON (From E. Prtl)	15,305			Completed	15,305	0					0	15,305
	BLIND CANYON	6,836	55	13.6	748	6,836	0					0	6,836
	MORONGO NO. 1	5,712				5,712	0					0	5,712
	MORONGO NO. 2	1,830	23	14.9	343	343	1487					0	1,830
	SAN JACINTO	(68,639)				(33,782)	(34,857)					0	(68,639)
	Cabazon Shaft to East Portal	8,653	90	4.5	409	7,112	1,541						
	West from Cabazon Shaft		90	1.1	103	8,906	33,316						
	East from Potrero Shaft	44,487	90	2.6	231	2,265							
	West from Potrero Shaft					5,118	0						
	From West Portal	15,499				10,381		Invert	0.4	65.0	26	733	67,906
	TOTALS Ft.	246,706	348	7.3	1,834	210,362	36,344	Arch	156	59.5	9,296	83,233	163,473
	Miles	(46.72)			(0.35)	(39.84)	(6.88)	Invert	0.4	65.0	26	14,593	232.113
DISTRIBUTION — CONTRACT													
GRIFFITH CO.	CAJALCO OUTLET	2,565			0	0	2,565					0	2,565
WEST CONSTRUCTION CO.	MONROVIA NO. 1 (From W.P.)	7,868		Completed		7,868	0					0	7,868
	MONROVIA NO. 2 (From Jct.1)	940		Completed		940	0					0	940
	MONROVIA NO. 3	(32,105)				(19,231)	(12,874)					0	(32,105)
	East from Adit	11,340	86	11.7	1,004	6,888	4,452						
	West from Adit		86	0.1	6	3,155							
	From West Portal	20,765	86	8.2	706	9,188	8,422						
DIXON, BENT BROS. & JOHNSON	MONROVIA NO. 4 (From W.P.)	8,096	88	2.2	194	2,906	5,190					0	8,096
J. F. SHEA CO., Inc.	SIERRA MADRE (From E. Prtl)	6,700		Completed		6.700	0		82	12.0	983	1,420	5,280
DIXON, BENT BROS. & JOHNSON	PASADENA EAST	5,546		Completed		5,546	0		81	10.8	874	1,346	4,200
	PASADENA (From West Portal)	12,140		Completed		12,140	0					0	12.140
	SAN RAFAEL No. 1 (From W.P.)	4,040		Completed		4,040	0					0	4,040
	SAN RAFAEL No. 2 (From E.P.)	5,669	86	10.9	941	1,522	4,147					0	5,669
	TOTALS Ft.	85,669	432	6.6	2,851	60,893	24,776	Full	163	11.4	1,857	2,766	82,903
	Miles	(16.23)			(0.54)	(11.53)	(4.70)	Section			(0.35)	(0.52)	(15.71)

TION PROGRESS

CANAL, CONDUIT, SIPHON & PIPE LINES

April 25 to May 9, 1936

CANAL, CONDUIT AND SIPHON (MILES)

	Completed	Remaining
Excavation	109.74	36.06
Concrete	100.54	44.21
Back Fill	39.73	42.86

DISTRIBUTION PIPE LINES (MILES)

	Completed	Remaining
Excavation	1.36	40.22
Concrete	1.02	40.56
Back Fill	0.66	40.92

AQUEDUCT

SCHED. NO.	CONTRACTOR	FEATURES	Length In Feet	EXCAVATION—Feet			CONCRETE—Feet			BACKFILL—Feet		
				Period	To Date	Remain'g	Period	To Date	Remain'g	Period	To Date	Remain'g
1	AQUEDUCT CONSTR. C.	Conduit and Siphons	22,025	0	21,600	425	1,662	20,820	1205	2,500	14,700	7,325
2	BARRETT & HILP AND MACCO CORP.	Conduit and Siphons	30,569	0	25,503	5,066	2,449	22,516	8,053	2,560	16,000	14,569
3		Canal and Siphons	40,700	0	37,895	2,805	262	31,577	9,123	460	1,160	11,485
4	JAHN & BRESSI CONSTR. CO.	Canal and Siphons	53,218	0	53,218	0	209	53,106	112	400	1,992	1,083
5		Canal and Siphons	53,588	0	53,588	0	0	53,588	0	0	4,020	0
6	WOOD AND BEVANDA	Siphon	15,521		15,521	0	2,017	15,521	0	639	13,043	2,478
7	BARRETT & HILP & MACCO CORP.	Canal and Conduit	27,707	0	27,707	0	0	27,707	0	0	12,170	0
8	WOOD AND BEVANDA	Canal and Siphons	49,579		49,579	0	30	49,174	405	0	7,090	800
9	UTAH CONSTRUCTION CO.	Canal, Conduit and Siphons	47,399	281	45,520	1,879	0	44,074	3,325	0	793	5,442
10	AQUEDUCT CONSTR. CO.	Canal and Siphons	44,505	0	44,505	0	0	44,505	0	1,565	4,694	156
11		Canal, Conduit and Siphons	44,507		0	44,507		0	44,507		0	10,462
12	THREE COMPANIES, INC.	Conduit and Siphons	32,977	24	28,755	4,222	275	27,200	5,777	0	23,030	9,947
13	AQUEDUCT CONSTR. CO	Canal, Conduit and Siphons	31,965	1,916	22,512	9,453	4,262	4,416	27,549		0	3,665
14	THOMPSON-STARRETT CO.	Conduit and Siphons	32,366	393	32,037	329	1919	30,667	1,699	608	19,860	12,506
15		Conduit and Siphons	35,849	0	0	35,849		0	35,849		0	35,849
16		Conduit and Siphons	19,359	0	0	19,359		0	19,359		0	19,359
17	M. W. D.—FORCE ACCT.	Conduit and Siphons	22,031	642	11,291	10,740	1,048	9,613	12,418	1,305	5,708	16,323
18	J. F. SHEA CO., INC.	Conduit and Siphons	27,537	818	11,286	16,251	1,594	9,712	17,825	2,729	3,309	24,228
18J	MORRISON-KNUDSEN CO.	Siphons	9,809		9,809	0	0	9,809	0	1,181	9,809	0
19	J .F. SHEA CO., INC.	Conduit and Siphons	37,464	0	0	37,464	0	0	37,464	0	0	37,464
20		Siphons	18,618	0	18,618	0	0	18,618	0	0	18,618	0
20 A & B	GRIFFITH COMPANY (Outlet Channel Unlined)	Siphons	735	0	705	30		0	735	0	0	735
21		Siphons	14,613		14,613	0	0	14,307	306	0	14,019	594
22		Siphons	7,229	428	7,229	0	1,132	4,287	2,942	1,400	3,825	3,404
23		Conduit and Outlet Channel	38,699	810	37,234	1,465	1,261	30,136	3,013	1,500	26,532	6,617
3	WINSTON BROS. CO. & WILLIAM C. CROWELL	Siphon (Gene Inlet)	1,877	140	1,305	572	93	93	1,784	0	0	1,798
	TOTALS		760,446	5,452	570,030	190,416	16,196	521,446	233,450	15,666	200,372	226,289

DISTRIBUTION PIPE LINES

1	AMER. CONC. & STL. PIPE CO.	Precast Concrete Pipe	12,227		0	12,227		0	12,227		0	12,227
2	WESTERN PIPE & STL. CO.	Welded Steel Pipe	54,530	900	1,725	52,805		0	54,530		0	54,530
3	AMER. CONC & STL. PIPE CO.	Precast Concrete Pipe	20,124		0	20,124		0	20,124		0	20,124
4			25,867	2,400	5,450	20,417	2,256	5,382	20,485	1,178	3,498	22,369
5			24,895		0	24,895		0	24,895		0	24,895
6	J. F. SHEA CO., Inc.	Precast Concrete Pipe	27,348		0	27,348		0	27,348		0	27,348
7			30,044		0	30,044		0	30,044		0	30,044
8	UNITED CONC. PIPE CORP.	Precast Concrete Pipe	24,525		0	24,525		0	24,525		0	24,525
	TOTALS		219,560	3,300	7,175	212,385	2,256	5,382	214,178	1,178	3,498	216,062

MISCELLANEOUS CONSTRUCTION

April 25 to May 9, 1936

AQUEDUCT PUMPING PLANTS AND APPURTENANT WORKS

CONTRACTOR	FEATURES	EXCAVATION—Cu. Yds.				CONCRETE—Cu. Yds.				STEEL—Tons			
		Est.Quan.	Period	To Date	%	Est.Quan.	Period	To Date	%	Est.Quan.	Period	To Date	%
WINSTON BROS. CO. & WILLIAM C. CROWELL	Intake Plant	102,400	3,000	35,920	35.1								
	Gene Plant	92,600	2,200	69,520	75.1								
WOOD AND BEVANDA	Iron Mt. Plant	358,700	68,400	202,400	56.3								
L. E. DIXON CO.	Eagle Plant	227,695											
NOT AWARDED	Hayfield Plant												
	TOTALS		73,600	307,840									

BOULDER TRANSMISSION LINE—FRITZ.ZIEBARTH

FEATURES	Length-Line Mi.	Period	To Date	Percent
Footings Constructed	237.0	19.8	112.5	47.5
Towers Erected	237.0	0.25	0.25	0.1
Wire Strung	237.0	0	0	0

TELEPHONE LINES—NEWBERY ELECTRIC CO.

FEATURES	Length-Line Mi.	Period	To Date	Percent
Converting Spur to Truck Line	7.8	0	7.8	100
Constructing New Trunk Line	139.5	34.5	90.4	64.8

PARKER RESERVOIR—SIX COMPANIES, INC.

FEATURES	Est. Quan.	Period	To Date	Percent
Diversion Tunnels—Excav.	3,463 Ft.	0	3,463	100
Diversion Tunnels—Concrete	3,463 Ft.	0	0	0
Dam Excavation	1,391,000 C.Y.	0	0	0
Dam Concrete	277,900 C.Y.	0	0	0

CAJALCO RESERVOIR—GRIFFITH COMPANY

FEATURES	Est. Quan.	Period	To Date	Percent
Diversion Tunnel	2,000 Ft.	0	2,000	100
Dam & Dike Excavation	651,000 C.Y.	35,120	85,290	13.1
Dike Fill	4,113,000 C.Y.	190,000	2,139,630	52.0
Dam Fill	3,410,000 C.Y.	0	0	0

COMPLETED FEATURES

TUNNELS

CONTRACTOR	TUNNEL	Length in Miles	Work Started	Work Completed
MORRISON-KNUDSEN CO.	Mecca Pass, No. 1, 2 & 3	1.13	7-17-33	2-10-35
WEST CONSTRUCTION CO.	Whitewater Nos 1 & 2	1.94	7-18-33	4-15-35
SHOFNER & GORDON	Hayfield No. 2	1.03	7-8-33	7-27-35
HAMILTON & GLEASON	Bernasconi	1.18	4-19-33	11-21-35
J. F. SHEA CO., INC.	Cottonwood	3.81	6-14-33	12-29-35
HUNKIN-CONKEY CON. CO.	Hayfield No. 1	1.84	10-21-33	1-9-36
DIXON & BENT BROS.	W. Eagle-W. Por.	2.02	9-8-33	3-12-36
	TOTALS	12.95		

CANAL, CONDUIT AND SIPHON

CONTRACTOR	FEATURE AND NAME OR SCHEDULE	Length in Miles	Work Started	Work Completed
UNITED CONC. PIPE CO.	LITTLE MORONGO SIPHON	0.13	2-27-34	8-20-34
M.W.D.—FORCE ACCT.	FAN HILL COND. & SIPHON	0.32	10-21-33	11-19-34
GRIFFITH COMPANY	SCHEDULE NO. 20-C	1.33	5-3-35	9-14-35
	TOTALS	1.78		

$1,766,721 Pump Motor Order Approved

Fifteen electric motors, which are to drive the pumps that will lift Colorado River water 1,600 feet on its journey between the river and the Coastal plain, were purchased May 15 by the Metropolitan Water District for a total price of $1,766,721.

This order, authorized by the Water District Board of Directors subject to the approval of the Reconstruction Finance Corporation, is said to be the largest of its kind ever placed. Having a total horsepower of 142,000, the fifteen motors will operate at 6,900 volts. Each motor installation will measure approximately 12 feet high and from 9 to 14 feet in diameter.

The purchases approved by the Water District board were as follows:

Six 9,000 horsepower motors, for the Gene and Intake pumping plants on the aqueduct, from the General Electric Company for $693,759.

Three 4,300 horsepower motors, for the Iron Mountain pumping plant, from the Allis-Chalmers Manufacturing Company for $288,400.

Six 12,500 horsepower motors, for the Eagle and Hayfield plants, from the Westinghouse Electric and Manufacturing Company for $784,562.

The fifteen huge units are to be operated with electrical energy generated at Boulder Dam. The Metropolitan Water District is now building a 237-mile, 230,000-volt transmission line, linking the five aqueduct pumping plants with the power house at the dam.

523 Make Merry At Dinner Dance

Attended by 523 merrymakers, coming from aqueduct points all the way from the river to the Los Angeles office, the Metropolitan Water District employees' dinner-dance, held at Oakmont Country Club, Glendale, on May 9, was hailed by one and all as setting a new high for District social events.

The committee which staged the affair, and which is taking bows for the richly deserved praise resulting from a first-class job, was made up of Hazel Clark, Chairman; Nadene Harvey, R. B. Diemer, K. Q. Volk, and Harry Richardson.

MONTHLY REPORT REVIEWS ACTIVITIES ALONG THE AQUEDUCT LINE

(EDITOR'S NOTE: The following is a brief summary of some of the District's activities as set forth in the monthly report, filed with the Board of Directors in May and covering work done in April. The report was prepared this month by Assistant Chief Engineer Julian Hinds in the absence of General Manager F. E. Weymouth.)

Legal Division

All necessary documents to secure payment for Interim Certificates Nos. 38 and 39, each in the principal sum of $2,016,000, covering bonds heretofore sold to the Reconstruction Finance Corporation, were prepared and payments for said certificates made on April 6 and 17. Transcript of proceedings relating to the sale of $11,808,000 District bonds sold to the R. F. C. on April 10 were prepared and forwarded to bond counsel and counsel for the R. F. C.

Miscellaneous Activities Division

During April, 1,274 employment applicants were cleared through the District's labor employment office as eligible, from the standpoint of residence, for work on the aqueduct. Of this number 434 were made available in response to requisitions on force account work, and 840 were made available for aqueduct contractors. Certificates of registration were issued to 550 applicants, making a total of 19,435 such certificates issued.

Field Engineering and Construction

Testing Laboratory—During the month of April approximately 324,200 barrels of cement were sampled and tested. A total of 29,000 gallons of coal tar cut-back sealing compound was tested. Twenty-eight samples of coal-tar enamel from Indianapolis were tested for the acceptance of 126 tons of this material and, in addition to these routine tests, a few samples were tested upon arrival of the first car.

Operation of Utilities—During the period March 15 to April 15, a total of 5,568,049 kw.hr. of power was used, 17,289 (long distance) telephone calls were handled, and 4,653,300 cubic feet of water was delivered.

Aqueduct Construction—See tables on Pages 4 and 5 for current construction progress figures.

Civil Engineering Division

Specifications and Contracts—Bids were opened April 22 under Specifications No. 152 for steel headframe and trestle for Lawrence adit. Specifications No. 150 for construction of buildings at Goffs Switching station by force account were approved April 20, and Specifications No. 155 for furnishing miscellaneous iron and bronze for Cajalco reservoir were issued April 29. Nine contracts aggregating $938,597.63 were executed during the month.

Design—Specification drawings were completed for Upper Feeder Schedules 9, 10, and 11, comprising 4.24 miles of 10-foot diameter pipe lines and appurtenant structures. Detailing of the arch dams and other structures for Copper Basin and Gene reservoirs continued.

Statistical Reports—Studies were continued and estimates of cost checked in connection with plans for increasing progress on San Jacinto tunnel.

Electrical Engineering Division

Progress was made on the structural, electrical, and mechanical design of the Hayfield pumping plant and on the specifications for construction of this plant. Four model pumps submitted by Byron-Jackson Company under its contract for pumping equipment for the Intake and Gene pumping plants were tested at the Caltech laboratory, each of the four impellers showing an efficiency of approximately 91 per cent, which is considerably above the efficiency expected. Plans and specifications were completed and materials ordered for the power substation to be installed at Lawrence adit. Installation of power service for operation of the mixing plant at the West Portal, San Jacinto tunnel, was completed.

Personnel Division

There were 70 classified positions filled during April, 64 of which were permanent and six temporary. Thirty-four of the permanent positions were filled by transfers from other classified positions and seven were filled by transfers from unclassified positions. The net turnover for all divisions for March was 11 per cent, and 10.03 per cent for the month of February.

Purchasing Division

A total of 2,011 purchase orders was issued during April, covering purchases amounting to approximately $230,644.

Accounting and Costkeeping

Actual costs up to April 30, 1936, amounted to $78,625,328.56, covering work and activities, the total cost of which is estimated at $155,487,754.